Date: 21.09.2023

EXPT. NO. ..... PAGE NO. .....01.....

Syllabus for pattern making workshop :

Definition: A pattern is a model or replica of desired casting which when moulded in sand, takes an impression in the sand called mould or cavity.

The mould when filled with molten metal, or other material, forms the casting of desired impression as was in the pattern.

Assessment I: Describe the following types of pattern with neat drawing —

a) Solid or single piece pattern
b) Split pattern
c) Match plate pattern
d) Cope and drag pattern
e) Loose piece pattern
f) Gated pattern
g) Sweep pattern
h) Skeleton pattern
i) Shell pattern
j) Segmental pattern
k) Hollow board pattern
l) Lagged-up pattern
m) Left and right hand pattern

Assessment II: 1] Draw all types of pattern tools and mention their uses in short

2] Write down the short notes on —

a) Shrinkage or contraction allowance
b) Draft allowance
c) Finish or Machining allowance
d) Distortion or camber allowance.
e) Rapping or shaking allowance

3] Give a chart of shrinkage or contraction allowance in m.m./mt of the following material— Gray cast iron, Malleable Iron, Cu, Al, Brass, Zn, Pb, Bronze, Steel.

Assessment III: 1] Job practices on making a hexagonal nut as solid pattern.

2] Job practice on making a hexagonal headed bolt.

Assessment IV: 1] Write different types of pattern making materials with their uses & advantage.

2] Write down the names of machines used in pattern making.

3] Write down the names of different measuring and layout tools.

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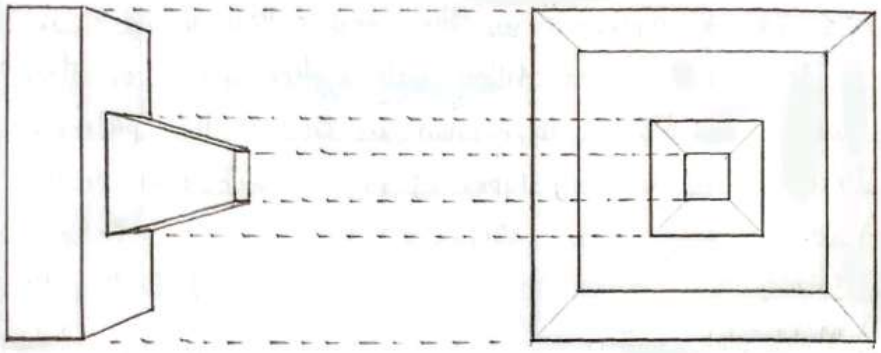
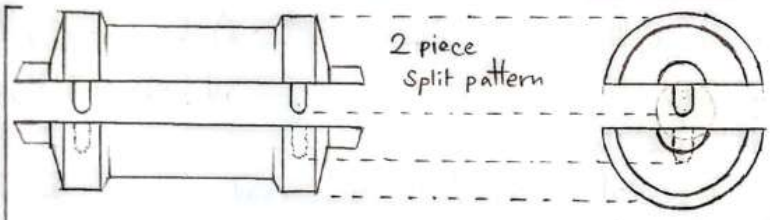
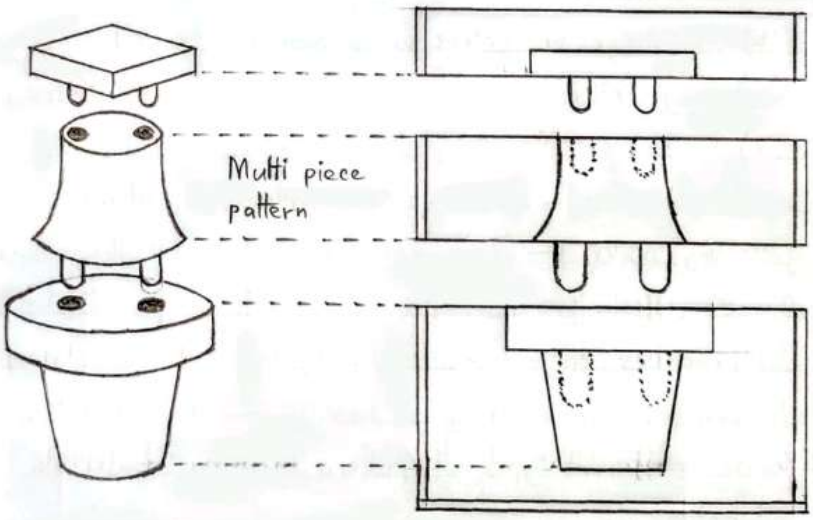
Solid or Single Piece Pattern



Split Pattern





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EXPT. NO. ..... PAGE NO. 02

Assessment I: Types of pattern

The types of pattern selected for a particular casting depends upon the following conditions — a) The shape of size of casting
b) The number of casting required
c) The method of employed

The common types of pattern are discussed in details in the following —

1] Solid or single piece pattern: A solid or single piece pattern has a compact form without any joints, parting or loose in it's construction surface that serves as a parting surface in it's mould. This type of pattern is used for a limited number of casting because most of moulding operation like parting, surface formation, cutting of galling system proiding rumers and reses with draw of patternaredone by hand.

2] Split pattern: Split pattern is made by 2 or more pieces to eliminate difficulties encountered in moulding them together in 1 piece. A pattern consisting of 2 pieces is called a two pieces split pattern. One half of the pattern rests in the lower parts of the moulding box, known as drag and the other part in the upper part of the moulding box, known as a cape. The line of separation of the parts is called parting line or parting surface.

Sometimes a pattern of complex casting is made in 3 parts such a made middle on being called a cheek.

The split patterns are commonly used for casting of spindles cylinder, stenand taps, bearing small pull gears and wheels.

3] Match plate pattern: Match plate pattern are used as machine moulding for quality at castings. A single pattern on a number of patterns may be made when moulded on a match plate cope and drag portion of the split pattern are mounted opposite side of the wooden or metal plate (usually aluminium), the pattern is called match plate pattern.

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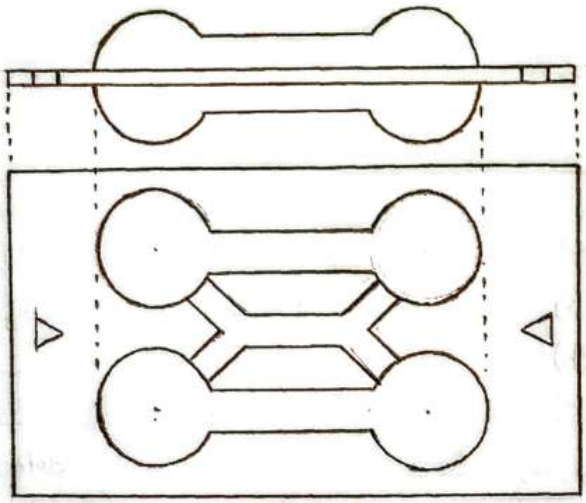
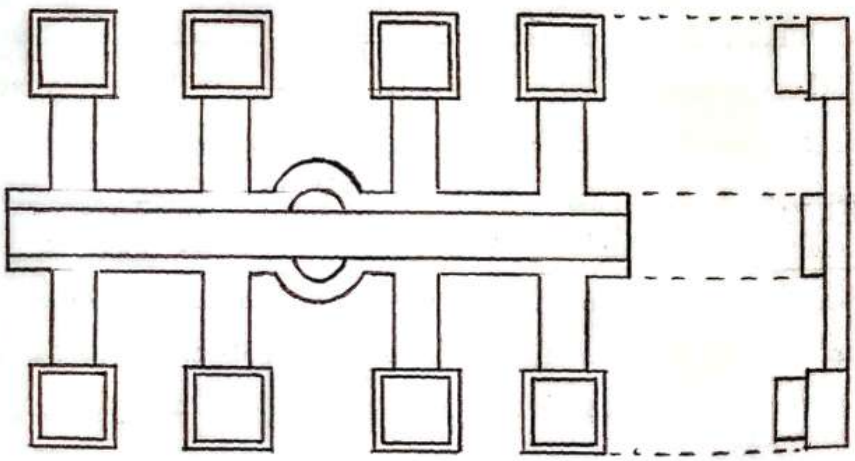




The gate and rummer are permanently fastened to the drag side of the plate which is their correct position in order to form a complete match plate. When the match plate is lifted off the mould, all patterns are withdrawn and the gates and muses are complete in one operation.

The Fig (IV) shows a metal pattern upon which it is quite high yet it is easily compensated by the high accuracy and maximum matching requirement of casting with the pattern of 2 small mounted dumbells.

4] Cope and drag pattern: When very large casting are to be made in complete mould, becomes too heavy to be handed by a single operation. In order to ease this problem, the cope and drag pattern is used. It is nothing but a 2 piece pattern split on a convenient joint line. One part is moulded on a cope and the other part in a drag of the moulding box.

5] Loose piece pattern: Sometimes a pattern has to be made with projections or over hanging parts as shown. The projection makes the pattern removal difficult. Therefore such projection are made in loose and fastened loosely to the main pattern by means of wooden or wire pins. These pins are taken out during the mould operation.

After moulding, the main pattern is withdrawn first and then the loose piece is removed with the help of lifters.

6] Gated pattern: The gated pattern is used for mass production small castings when a number of small patterns may be provided with a gate pattern with it. It consists of piece of wood or metal to find the pattern from the rummer and rising channels in the mould. In this way, full supply of molten metal flows into every parts of the mould.

The gated pattern eliminates hand cutting of gates and this makes the moulding easy. If a group of pattern is to be placed in one mould the gated pattern has a further function of holding the pattern in the proper position.

Teacher's Signature: .....

7] Sweep pattern: The mould of layer size and symmetric in shape particularly of circular section can easily prepared by using a sweep instead of a full pattern. It is not considered as a new pattern when compared with others. A sweep pattern is compared with material which has the shape corresponding to the shape and size of casting. It is arranged to rotate about the central axis by moulding it on a spindle. The sand is rammed in place with a board approximately similar shape and size to that of the required mould. Now by remoulding the sweep, the cleared shape of the mould is generated. The sweep and the spindle are than renewed and the central hole is filled up advisable to use a large solid pattern of that size as it will require a lot of wood and time.

8] Skeleton pattern: When a jaw and large sized casting is required, it is not advisable to use a large solid pattern of that size, as it will require a lot of of time and wood to make a full pattern. In such cases, a skeleton in the hollow form casting of a wooden frame and strips is used as the pattern.

In skeleton pattern frame is filled and rammed with loam sand and strickle board, excess sand is scrapped out of the space between ribs so that the surface is even with the pattern outside. The skeleton pattern is made in 2 halves, 1 for the cope and other for the drag, are assembled together with the cope in position to form the complete mould. The skeleton patterns are used for castings of the following – iron pipe bends, valve and boxes.

9] Segmental pattern: The segmental are known as part pattern, these are section of a pattern arranged as to form a complete mould by being moved to form each section of mould, usually applied to circular work, such as ring, wheels rims, gears etc. When a mould is to be made using a segmental pattern, a vertical spindle is finally fixed in centre of the drag flash. Then the mould bottom is removed to swift level. Now the segmental pattern is fastened to the spindle, the moulding sand is rammed between the outside of the pattern, the flash and on the inside except at the ends

of the pattern after removing 1 segment, the other is removed soon.

10] Shell pattern: Shell pattern is an expandable casting for mould that uses resin covered sand with 2 piece metal pattern. It is used when large, solid, detailed accurately shaped parts are to be moulded. The pattern is efficient for metal only, made from resin covered sand and then ready for moulding. It is used for moulding Cylinder head, connecting rod, engine blocks and manifolds, machine bases etc.

11] Hollow board pattern: A hollow board pattern is used for solid pattern having an irregular parting line, sometimes with either single or multiple gated pattern. The pattern requirement for hollow board are usually difficult to make as a split pattern. The board is mounted out so that the pattern rest in it is up to the parting line and this board acts as a moulding board for the first moulding operation.

12] Legged up pattern: When a pattern in core box is so large of such form that it's concentration to be made so economically from a solid piece or when such method could result in a pattern of little strength or excessive weight that it's necessary to use a legged up or strong pattern.

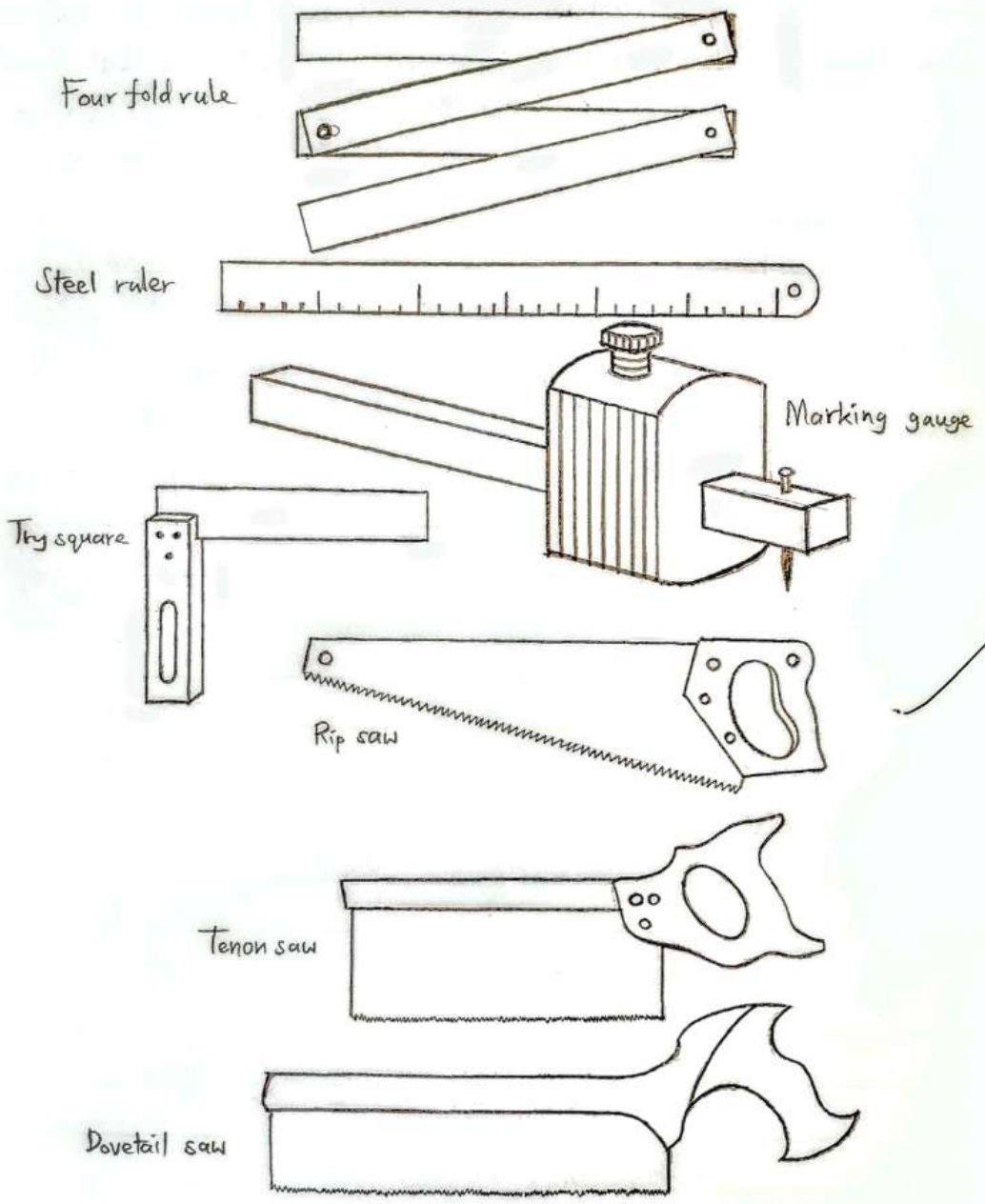
The cylindrical pattern eg- barrel pipes as columns are built up with logs or stone construction strips of wood be put on each side for making it's joint tight outside. These legs are glued or nailed or screwed to the wooden pieces called heads such as construction gives the minimum amount of these to little excess stock to be removed.

13] Left and right hand pattern: Some pattern are required to be pairs and when their form is such that they can't be reversed and hence the centres of hubs & bosses etc; opposite and in line, they must be made right and left hand. 'J' hangers for overhead shaft line, legs for wood turning lathe or garden bench or for paddle

Teacher's Signature: .....

type sewing machine, and brackets for luggage racks in the railway carriages are few examples where this pattern is required.

For example, a bracket is an example of casting from left and right hand pattern where the hub and the foot flanges are fastened with screws and moved from side to side for making the pattern right and left hand.


Four fold rule
Steel ruler
Marking gauge
Try square
Rip saw
Tenon saw
Dovetail saw

Date: 26.09.2023

EXPT. NO. ..... PAGE NO. .....07.....

Assessment 2 : [1] All types of pattern making tools and their uses

There are 6 types of pattern making tools in general —

I] Measuring tools
II] Marking tools
III] Cutting tools
IV] Planning tools
V] Holding tools
VI] Smoothing tools

I] Measuring Tools :

i) Four fold rule : It is a wooden scale consisting of 4 pieces each of 15 cm long, linked together by means of pins.

ii) Steel tape : A steel tape is used for measuring longer dimension, available in 2 meters.

II] Marking tools :

i) Marking gauge : It is used to make a parallel line from the wood piece edges, consisting a small stem sliding in jacks. The stem carries one or more marking point or a cutting knife. The stock is set on a descibed distance from the steel point and fixed by thumb screw. The gauge is hold firm against the wood edge and rushed along the steel point marking of line.

ii) Try square : A try square is used to check 90° angle on pieces of wood.

III] Cutting tools :

i) Rip saw : Rip saw is a high grade steel blade pinned in a wooden handle by means of rivetes and screws, used for casting along the glairs in wood.

ii) Tenon saw or hacksaw : This saw is used to cross cut fixed and accurate finishing edges. It's blade is reinforced with a rigid length and edges with equilateral triangle shaped jaws sometimes turned as plugteeth

iii) Dovetail saw : It has a long carbon steelblade with a thick, opaque back with higher numbers of jaws which enable it to penetrate cleanly yet effortessly. These requirements occur usually in case of dovetail joints and other sharp 'V' groomen.

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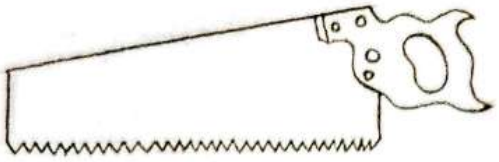
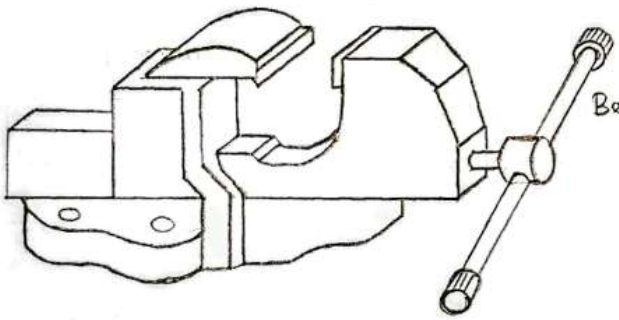
Hand saw



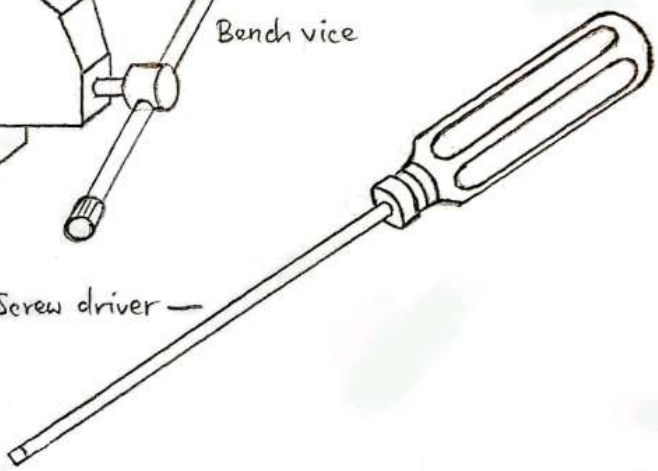
Iron jack plane

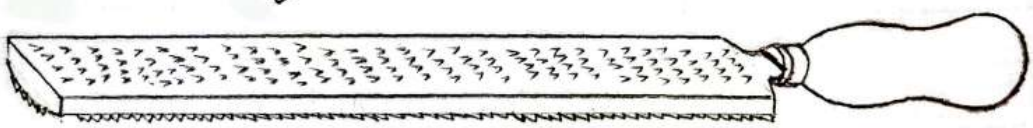
Claw hammer



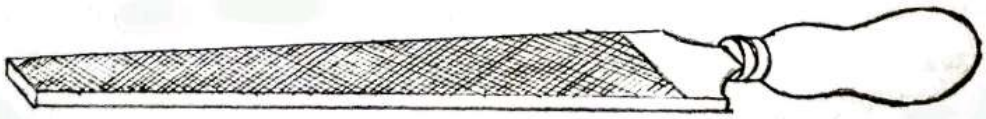
Bench vice

Screw driver





Rasp file



iv) Hand saw : It is primarily designed for cutting across grains of wood, used for general purpose wood length cutting, usually of 50 – 70 mm blade length with 4 jaws per cm length with a pitch prepared for hard wood or soft wood.

IV] Planning tools :

i) Iron jack plane : Iron jack plane is used to remove minor thickness or to give the wooden plane a smoother finishing, also comes in smaller sizes such as metal jack saw plane and in bigger size as wooden jack plane.

ii) Claw hammer : A claw hammer is used for low effort works, usually serves dual purpose of punching nail and plucking it out by the claw side.

V] Holding tools :

i) Bench vise : The bench vise is the mostly used tool, made of metal or wood, used to hold the wood or the object underneath with grip and thereby work on the object. It has one jaw fixed to vise and the table and another one movable along with screw handle. By using it we can plan, drill, saw, smoothen the object. It's used widely in mechanical and wood working industries.

ii) Screw driver : Screw drivers are usually hand operated for screwing in and out with a flattened tipped metal stick. These come in various types, shapes and sizes but cabinet screw driver is considered the best type.

VI] Smoothing tools :

i) Rasp and file : A rasp and a file are used to smoothen wooden surface by it's shape projections where rasp has sharper jaws to peel and rasp has smaller jaws that peel.

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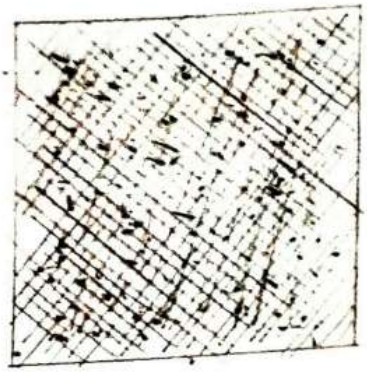

Glass paper

both consists of a tapered rectangular, round on half round sectional bar of case hardened steel with distinct individual cut Tella.

ii) Glass paper: Further smoothening after rasp and file can be done by glass paper coated with extremely fine glass fibre, sometimes used for rust removal of iron and paint removal.

[2] Casting or moulding allowances

I] Shrinkage or construction allowance: Various metals are used for castings construction after solid fixation in the mould. Since the construction is different for different metal, therefore these corresponding allowances differ and there is a stricles on construction scale for each type of metal used in a casting.

II] Draft allowance: This allowance is tapper which is given to all vertical walls of pattern for easy, plain withdral of the mould casting without damaging the mould and the pattern. It is expressed in mm/mt or degree, varies with hand and machine moulding due to friction difference. It further depends on the complexity and details in case of machine moulding.

[3] A Chart on shrinkage or construction allowance for following

Types of materials	Construction allowance mm/mt
Gray cast iron	7 - 10.5
White cast iron	21
Rellable	15
Copper, Brass and Aluminium	16
Steel	20
Zinc steel	24
Bronze	10.5 - 21
Magnesium	18

III] Finish or machining allowance: This allowance is produced on the pattern if the casting is to be machined, given in addition to shrinkage allowance. It depends completely on the material with surface defects, dimension, accuracy required for the output. The undesired volume of material provided is removed by this allowance completely with machining operation. To reduce machining allowance and it's cost, it is better to place entire casting inside the drag flask such that reducing defect due to parting plane remain intact.

IV] Distortion or camber allowance: To prevent distortion or bending in casting on cope up or other prone areas, due to internal stress during heating and cooling, a camber is

used as a distortion allowance in the opposite direction so that it gives required internal pressure to prevent distortion, bend, uneven thickness.

V] Rapping or shaking allowance: Shaking or rapping allowance is known as negative allowance used to ease the removal of pattern from casting sand or the mould. In small and medium size this can be neglected but in larger castings the casting pattern has to be rapped or shaken to make the pattern slightly smaller than casting, however a negative allowance is provided to the dimensions parallel to the parting line to reduce casting mould enlargement.

Date: 30.03.2023

EXPT. NO. .....

PAGE NO. 11

List of safety rules in the Pattern shop

1] Always follow all rules and regulations generally displayed in the shop.
2] Work more than talk.
3] Always wear proper and tied dress in the workshop along with apron. Don't wear loose dress.
4] Always use sharp and properly working tools and equipment for every job, don't use broken tools. Always examine every tool before using.
5] Don't use or strike with hammer on the handle of screw driver, jack plane and bench vise.
6] Do not work sitting on the chair.
7] Never keep any sharp tools in pocket.
8] Always clean the working bench, bench vise after finishing the job.
9] Keep every tool and equipment on it's proper place after job.
10] Don't mix cutting tools with other tools.

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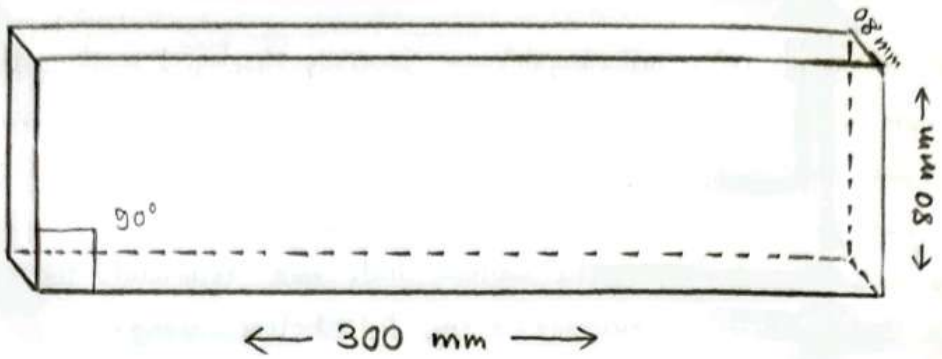
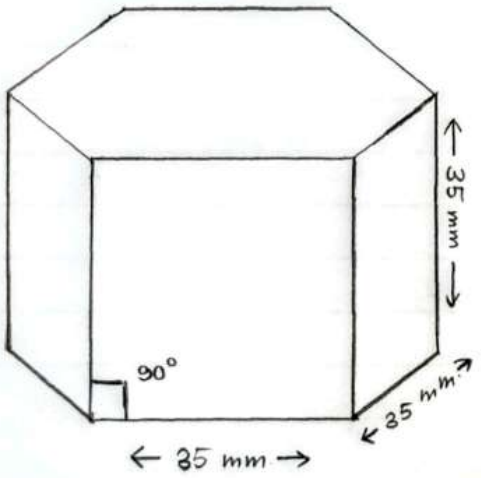

80 mm
90°
300 mm


35 mm
90°
35 mm
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Date: 01.10.2023

EXPT. NO. .....

PAGE NO. .....12.....

Assessment 3 : Job practice

I] Aim: To make a cuboid from supplied material as per dimensions given.

Practice material : Soft wood

Tools used : steel ruler, 4 folded wooden foot rule, measuring tape, try-square, pencil, hand saw, tenon saw, bench vise, rasp, file, jack plane.

Operation :
i) Measuring
ii) Marking
iii) Cutting (sawing)
iv) Testing
v) Smoothing

II] Aim: To make a hexagonal solid pattern from supplied material as per dimensions given.

Practice material : Soft wood

Tools used : Steel ruler, 4 fold rule, measuring tape, pencil, hand saw, tenon saw, jack plane, bench vise, try-square, rasp, file, jack plane.

Operation :
i) Measuring
ii) Marking
iii) Cutting (sawing)
iv) Testing
v) Smoothing

Teacher's Signature: 10/10/23

Date: 01.10.2023

EXPT. NO. ..... PAGE NO. 13

Assessment 4: [1] Types of pattern making material

I] Wood: It is the most widely used material, further into Sugar Pine is most commonly used wood amongst, because it's soft, light and easy to work. Wood is used for cheaper purposes when very less pattern are to be handmade by non industrial individuals, it's easily sanded to smooth surface and can be soldered, bonded or connected multiples. Honduras mahgany was used for multiple parts production because of hardness and durability. Once properly curved, it is subject to warping, cutting. Once the pattern is built, the foundry doesn't want it's changing shape.

II] Metal: Due to durability and smoothness, metal patterns are commonly popular and used for industrial and perfection purpose. Various metals like cast iron, brass etc can be used but white metal and aluminium are mostly used because of light weight and corrosion resistance.

III] Plastic: Thermoset plastics are used as pattern making material because of low cost, light weight, high strength, no corrosion, low solid shrinkage, smooth finish, durability, dimensional stability etc. Therefore special material castings are moulded on plastic patterns.

IV] Plaster: Plaster of paris or gypsum is successfully used as a pattern material because it's easy to make, adaptibility to intricate shapes, no compression and controlled expansion. Usually used for making small patterns and core boxes of intricate shapes.

[2] Measuring and layout tools in Pattern making

i) Angle finders
ii) Protractor
iii) Callipers
iv) Micrometer
v) Precision measurement
vi) Plumb bobs
vii) Laser distance measure
viii) Rulers

Teacher's Signature: .....